STANDARD OPERATING PROCEDURE

Sampling of Carbonyl Compounds in Air

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21917 Craftsman Road
Calabasas, CA 91302

I. INTRODUCTION

Carbonyl compounds in air are collected by drawing air through a cartridge impregnated with acidified 2,4-dinitrophenylhydrazine (DNPH). The resulting products(hydrazones) are measured in the laboratory using high performance liquid chromatography to determine the levels of the carbonyl compounds originally present in air.
Unlike the C18 substrate, DNPH impregnated on silica substrate (Si-DNPH)have significant negative ozone artifacts and their use will require an ozone denuder or scrubber to be installed at the air inlet of the sampler immediately in front of the particulate filter. The ozone scrubber is good for approximately 100,000 ppb-hour, or approximately one month of use. The ozone capacity of scrubbers have not been officially determined. So daily changing may be required.

II. SAMPLING

The sampler is equipped with timers, which, once programmed, will allow multiple samples to be taken automatically. All channels except the Duplicate are independent. They can be programmed to sample over any time period though NOT simultaneously (as in collecting a parallel sample) because they share the same flow controller. To collect a parallel sample, the duplicate Channel is used. It will collect a sample simultaneously with one of the designated channels (e.g. Ch. 2 in a 4-channel unit) if the toggle switch is set to the **Dupl.** position. If the toggle is set at the **Blank** position, that “duplicate” channel serves to collect a field blank. The sampling flow rate through the cartridge is regulated by differential flow controllers to approximately 800 ml per minute.

THE SAMPLER IS NOT WEATHER PROOF. IT SHOULD BE USED INDOORS ONLY. ALWAYS USE UNITS A & B DESIGNATED WITH THE SAME NUMBER TOGETHER (as in 5A & 5B) since flow calibration is done on the unit as a pair.

PROCEDURE

AtmAA provides two types of samplers (Type 1 and Type 2), both of which operate similarily, but differ in the type of housing and timers used. One type uses Omron timers and is housed in a tool

box. The other type is housed in a rack-mount chasis and uses a SprinkerThinker timer for control.

Installation:

Place the sampler (unit A) and pump (unit B) on a table. Remove the protective caps on the fittings. Save the caps and other miscellaneous parts in the Ziploc bag inside the pump box. Connect the vacuum line/s between the two units. Type 1 has only one such line, whereas Type 2 has two lines. In this case, connect the Dupl. from the pump box to the Dupl. channel at the back of the chasis. Make sure there are **two O-rings and an inverted ferrule** (a back ferrule used with wide end facing the O-ring) at each end of the line. Finger tighten the fittings. If the line does not slide from the fitting upon gentle pulling, the connection is good. Prop the pump box lid up with the metal rod by inserting it into the groove at the corner of the lid. **The pump must be operated with the lid open**. In the Type 1 sampler, plug the sampler power cord to the power socket in of the sampler, then plug the pump unit power cord into an AC outlet. In the Type 2 sampler, the pump power cord plugs into the sampler outlet and AC is applied to the sampler unit.

1a: Type 1 Sampler:

The Omron timer in the pump box should come on when power is applied. Slide Ch. 2 (marked AC outlet) to **ON**. Test the set up by sliding the timer switch marked "**P**" to **ON**. The pump should start. With the pump running, switch each channel in the sampler ON, then OFF in succession. Each time a channel is turned on, a click should be heard, indicating that the solenoid valve is activated. At the same time, suction should be felt at the black Viton tubing for that channel. When the corresponding channel is on, vacuum should also be felt at the DUPL. (duplicate) channel if the toggle is at the **DUPL**. position. **ALL CHANNELS SHOULD BE WORKING BEFORE PROCEEDING WITH THE FOLLOWING STEPS. Place all timer switches to RUN after this test.**

1b: Type 2 Sampler

The SprinkerThinker timer runs on battery and should have been on already. When AC power is applied, the timer can turn on the pump (Ch. 6) and the other channels manually using the 4 keys. See Supplemental Instructions on the timer operations.

2. Install the filter provided to the sampler inlet fitting marked AIR and connect the sample inlet line (1/4 inch Teflon, ~ 20 ft) to the filter. Be sure to **note the direction of the arrow on the filter holder**. It should be pointing towards the sampler. Finger tighten the Teflon fittings in the holder, but wrench tighten the brass Swagelok cap nut. Any ozone removal unit should be installed between the air inlet line and the filter. Strap the other end of the sampling line to the desired location.

3. Insert the blue polyethylene tubing to the pump outlet and vent the pump exhaust outside, away from the sampling inlets of other sampling or monitoring equipment.

4. The sampler comes pre-installed with blue "protective" tubing stubs. They are for keeping particles out of the lines. Separate the lines from the stubs and save them in the Ziploc bag. Take a fresh cartridge from a vial. Remove the plugs and save them inside the vial. Connect the cartridge to the Luer fittings, with the **long end** going to the **black Viton** tubing in Type 1, or the **Teflon** tubing in **Type 2** units. Install cartridges into as many channels as you need to sample including blank or duplicate. **Leave any unused channels closed with the blue tubing stub.**

5. For each cartridge sample, record in a log sheet the following information and any remarks for events relating to a sample:

   - **cartridge number**
   - **installation date and removal date**
   - **elapsed time meter reading before and after sampling**
   - **sampling date and time of each cartridge**
   - **sampler and channel number**
   - **toggle switch position - Dupl. or Blank**

   Do not leave any field in the logsheet blank. The data log sheet may be different depending on the project. An example of a data form is attached in the Appendix.

6. The timers have been pre-installed with the sampling program and should not need changing. So when an IOP comes up, the operator only needs to set up the “Go” days in the controlling channel: AC OUTLET in the Omron, or Valve 6 in

the SprinkerThinker, and the sampling program takes over. The sampling program varies depending on the specific application. Supplemental project-specific instructions will be provided to aument this S.O.P. on the operations of this sampler in these programs.

7. After sampling, the cartridges should be removed as early as your schedule allows. Remove the cartridges, and immediately plug the ends tightly. Place them into the vials and screw on the caps tightly.

8. Keep all exposed cartridges in a closed, clearly labeled sealed container in a refrigerator to avoid mixing up with fresh cartridges. File away the log sheets in a folder or binder. **Always have a copy of the log sheet at the field location or operation center for reference** in case the laboratory has any questions regarding the sampling.

9. Return exposed cartridges and log sheets in a cooler with blue ice to:

   AtmAA, Inc.
   23917 Craftsman Road
   Calabasas, CA 91302
   Attn: K. Fung

   Voice: 818/223-3277
   FAX: 818/223-8250

   Overnight delivery service should be used for the shipment. If you put the log sheets inside the cooler, put them inside a sealed Ziploc bag to protect them from moisture.

10. Cartridges may be returned on a batch basis to the laboratory for analysis.

CHECK LIST:

Protective stubs installed in unused channel?

Toggle switch position in DUPL. or Blank?

Omron timers synchronized and switches in RUN position for used channels?

Timer controlling channel set to operate on the correct day?

Pump box lid prop open?

Log sheet filled in?

INSTRUCTIONS TO ACTIVATE SAMPLER:

I.SprinklerThinker:

To Start an IOP

1. Press Γ→ until the valve icon appears and check that valve 6 is selected (➘ pointing at 6). If not, press ⇨ once (to enter into the change mode). The ➘ now flashes (for a few seconds). Use + or − to position the flashing ➘ opposite to valve number 6.

   Note: In the change mode, the unit automatically resets itself after a few seconds. Just press ⇨ to re-activate the change mode if the change has not been executed in time.
2. Press Γ→ until the day icon appears. Press ⇨ *once*. Use ***ONLY*** the − key to cycle the flashing arrow through ***all seven*** days of the week to cancel ***any*** previously selected days of the week (indicated by a non-flashing arrow). Then place the flashing arrow on the desired day of week, i.e. an IOP day.
3. Press + once to select the day. A non-flashing arrow should now appear against the selected day and the flashing arrow moves to the next day of the week. Only one day should be selected at any time. Check that there is only ***ONE*** non-flashing arrow.
4. Press Γ→ a number of times (7 times) until the 🕑 icon appears on the bottom right corner of the screen. The screen should indicate current day of the week and time.
5. Install the sampling cartridges and complete the Chain-of-Custody form. Do not leave any space blank. Note the toggle position and verify the cartridge numbers and corresponding channel numbers. A carbon copy of this COC form should be with the unit should there be questions regarding an entry.

Second & Subsequent IOP Days

1. The technician may service the sampler after 8 p.m. to retrieve all exposed cartridges and reload all the channels. Go to Step (4).
2. Another option is to service the sampler between 9 am and 12:30 p.m. on the first IOP day.
3. Retrieve all *exposed* cartridges (only in Ch. 1 and 2 on the second day, but all channels from the third day on) and replace with fresh cartridges.

4. Enter the cartridge and corresponding channel numbers, date in the COC form. The exposed cartridges should go into a container marked for exposed cartridges. Keep all cartridges refrigerated except those in the sampler.
5. Press Γ→ and select valve 6.
6. Press Γ→ until the day icon appears. Press ⇨ **once** to enter the change mode.
7. Press - to move the flashing arrow to the current day, hit + twice to select the current and following day. Do not pause more than a few seconds between successive keystrokes.
8. Two solid arrows will appear to indicate that the current day and the next day have been selected to run.
9. Press Γ→ a number of times (7 times) until the 🕑 icon appears on the bottom right corner of the screen. The screen should indicate current day of the week and time.
10. For subseqent IOP days, repeat steps (1) throught (9) of this instruction.

II.OMRON TIMER:

To activate sampler, hold **MODE** down for ~2 sec. When **TIM ADJ** appears, press **MODE** 4 times to enter the **PROG 2 DAY SET** screen. Press ↵ to move blinker to the desired day. Press + or – followed by ↵ to select or cancel a selection. Press **MODE** to exit.

After the last day of an IOP, remove all previous selections. The next IOP should always begin with new selections to avoid resampling.

To activate sampler, hold **MODE** down for ~2 sec. When **TIM ADJ** appears, press **MODE** 4 times to enter the **PROG 2 DAY SET** screen. Press ↵ to move blinker to the desired day. Press + or – followed by ↵ to select or remove the day. Press **MODE** to exit.

After the last day of an IOP, remove all previous selections. The next IOP should always begin with new selections to avoid resampling.

Carbonyl Sampler with Omron Timers

CCOS Porgram

Timer	Channel	On	Off	Days On	Switch Position	Remarks
1	1	0:03	3:03	every day	RUN	Sample
	2	6:00	9:00	every day	RUN	Sample
2	3	13:00	16:00	every day	RUN	Sample, Dupl. on Ch. 7
	4	17:00	20:00	every day	RUN	Sample
3	5	0:00	0:03	every day	RUN	System purge
		5:45	6:00	every day	RUN	System purge
		12:45	13:00	every day	RUN	System purge
		16:45	17:00	every day	RUN	System purge
	6	Not used		none	OFF	
4	pump	0:00	3:05	every day	RUN	
		5:46	9:02	every day		
		12:46	16:02	every day		
		16:46	20:02	every day		
	AC	0:00	20:04	to be set	RUN	Set "DAY SET" to IOP

CARBONYL DATA AND CHAIN OF CUSTODY SHEET

Project: **Central California Ozone Study** **Sampler Number:** _____

Site: _____ **Pump Box Number:** _____

Operator: _____

Cartridge									Toggle Switch		Installation		Removal		Elapsed Time	
Channel	1	2	3		4	Blank/Dupl.		Exposure	Position (check one)						Meter Reading	
Smpl. Period	0-3	6-9	13-16	Tandem	17-20	Blank	Dupl.	Date	Blank	Duplicate	Date	Time	Date	Time	Start	Stop
Cartridge #																
Cartridge #																
Cartridge #																
Cartridge #																

Chain Of Custody:

Relinquished By: (Signiture) Date / Time: _____

Received By: (Signiture) Date / Time: _____

Comments: Use this sheet for consecutive IOP days

APPENDIX

INSTRUCTIONS FOR OMRON TIMERS

To set and program this timer, you only need to use 4 keys: **MODE**, ↵(the **ENTER** key, located to the right of MODE), **+**, and **-**.

1. **To set day of the week, hour and minute in Time Adj mode**:

   Hold down the **MODE** key for about 2 seconds to enter the **Time Adj** (adjust) mode. The flashing parameter can be changed with the **+** or **-** keys followed by ↵ (**Enter** key) to set the change. After each ↵ stroke, the next parameter will flash (cycling from day of the week to hour to min. and back). The timer is on a 24-hour clock, with 0:00 being midnight.

   To get out of the **Time Adj** mode, repeatedly tap the **MODE** key until the normal time display is shown (a flashing ":" between the hour and minute display).

   *Note: The **MODE** key is inactive if you have used the **+** or **-** key, but have not set the entry with the ↵ key.*

2. **To view or enter a program**:

   An Omron timer controls 2 circuits by the programs **under Prog 1** and **Prog 2**. The two switches on the timer put each circuit in one of 3 modes: **ON** (mannual on), **RUN** (Program), and **OFF** (manual off). The swiches are labelled to indicate what each circuit controls, for example, 1 for Ch. 1, 2 for Ch. 2...and P for pump.

   Push and hold **MODE** key for about 2 seconds. When the **Time Adj** sign comes on, tap the **MODE** key once to enter into **Prog 1**. View the hour, minute, and switch 1 status (shown at the bottom left corner of screen): **ON**: a bar in contact with the poles, **OFF**: a bar away from the poles, and **OPEN**: no bar, implying no program steps). Changes can be made to the flashing parameter with the **+** or **-** keys and then ↵. **If no change is required, use ↵ to go into the next field**. The timer **sequences through hour, minute and switch status** for all the steps within Prog 1 until 0:00 with an open switch

status are shown, signifying that no further steps are in Prog 1. Further tapping the **Enter** key will loop you back to step 1 again.

Verify all the ON and OFF times. If you are satisfied with the entries, hit **MODE** once to go into **Day Set**, which sets the days of the week that Prog 1 will be on or off. If the display shows the days of the week in clear letters against a black background, **Prog 1** is on for those days (also indicated by the switch pictogram). Make all necessary changes with **+**, **-** and ↵ keys.

Hit the **MODE** key once to go into **Prog 2** to verify or change the entries in the program steps and Day set as described above.

Hit the **MODE** key once will return you to the normal display.

3. To synchronize the timers:

Set the first timer to the correct time. Get into the **Time Adj** mode of the second timer and set the time one minute ahead of the first timer. As soon as the minute display changes over in the first timer, hit ↵ of the second timer. Then tap the **MODE** key repeatedly to return to the normal display.

INSTRUCTIONS FOR SPLINKERTHINKER TIMERS

The timer is programmed with the aid of 4 buttons, Γ→, −, +,and ⇨.

1. Programming Current Time and Date

Press Γ→ a number of times until 🕑 icon (now) appears. Press ⇨. The hour digit will flash. Use + or - buttons to set the current hour (note: AM and PM). Press ⇨ again, and the minute will flash. Use + or - buttons to set the current minute. Press ⇨. A flashing arrow will appear in the upper portion of the display. Use + or - buttons to set current day.

Press Γ→ to move to the next step (**valve**).

2. Valve Selection

Press Γ→ until the valve icon appears. Press ⇨. A flashing arrow appears on the lower screen. Use + or - to position the arrow opposite the valve number that you wish to program. *The arrow will be in constant display in all subsequent steps (duration, day, starts, manual etc.) to indicate that the programming will pertain to this valve (channel) selected.*

Press Γ→ to move to the next step (**duration**).

3. Run Duration

Press Γ→ until an icon appears against “duration”. Press ⇨ and use + or - to set the desired duration.

Press Γ→ to move to the next step (**day**).

4. Sample Days

Press Γ→ until an icon appears against “day”. Press ⇨ and a flashing arrow appears opposite the days of the week. Use - to move the flashing arrow to the desired day of the week. Press + to select. A solid arrow will appear against the selected day, and the flashing arrow will move to the next day. Pressing the + or - keys will cycle the icon from “M” to “Su”(Sunday) and back.

WARNING: *The ⇨ key can also be used to pace through the days of the week. But it will go to “OnCe” after “Su”. In this mode, all*

the programs in Starts will be cleared. You must immediately press ⇨ while OnCE is still flashing to get out of that mode and back to "M" to avoid erasing the programs in Starts.
The best way is to avoid using ⇨ to pace through.

Press Γ→ to move to the next step (**start**).

5. Start Times

We are using only one of the 4 allowable start times. Press Γ→ until "[1]" appears against "start" for start number 1. The word "OFF" or the last start time entered will appear. Press ⇨ once and use + or - to make the changes to the desired start time (note AM and PM), followed by ⇨. To cancell a start time, press ⇨. Use + or - till "OFF" appears (between 11:xx PM and 12:xx AM).

Press Γ→ to move to the start 2, 3, and 4, which should all be OFF. If not, set them to OFF.

Press Γ→ to move to the next step (**mannual**).

6. Manual Operation

Press Γ→ until an icon appears against "manual" and the word "OFF" is displayed. Press + will turn the valve (selected earlier) ON. Press - to turn it OFF.

Press Γ→ twice to skip "rain off" into the "now" (🕑) screen, which displays the current time and date of the week.

7. Timer Program Review

To review the programs in the timer, press ⇨ a number of times until you are in the “now” screen. Check that the current time and date of the week are correct. Then press ⇨ once. In the valve screen, select the valve(Channel) to be reviewed using + or -. Press ⇨ successively to observe the display under each mode (duration, days, starts) to ensure the settings are consistent with the values shown in the table below. If not, make the necessary changes.

Repeat the review on the other valve settings until all settings are confirmed.

CCOS SPRINKERTHINKER TIMER PROGRAM

valve	duration	days	starts
1	3:00	M thru' Su	12:03am
2	3:00	M thru' Su	6:00am
3	3:00	M thru' Su	1:00pm
4	3:00	M thru' Su	5:00pm
5	0:00	none	-
6	3:20	none (set before IOP)	12:00am; 5:45am; 12:45pm; 4:45pm

TAMDEM SAMPLING:

Type 1 Sampler:

Type 2 Sampler:

CARBONYL DATA AND CHAIN OF CUSTODY SHEET

Project: CRPAQS _____ **Sampler Number:** _____

Site: _____ **Pump Box Number:** _____

Operator: _____

Cartridge Installation									Toggle Switch		Installation		Removal		Elapsed Time	
Exposure	**Channel**	**1**	**2**	**3**		**4**	**5**		Position (check one)						Meter Reading	
Date	Period	00-05	05-10	10-16	Tandem	16-24	Blank	Dupl.	Blank	Duplicate	Date	Time	Date	Time	Start	Stop
(top unit)	**Cartridge #**															
(bottom unit)	**Cartridge #**															
(top unit)	**Cartridge #**															
(bottom unit)	**Cartridge #**															

Chain Of Custody:

Relinquished By: (Signiture) Date / Time:

_____ _____

Received By: (Signiture) Date / Time:

_____ _____

Comments: Use this sheet for consecutive IOP days

On		Collect			On		Collect	
IOP Days	Blank	Duplicate	Tandem		IOP Days	Blank	Duplicate	Tandem
1					1			
2					2			
3	yes				3	yes		
4					4			
5		yes			5		yes	
6					6			
7			yes		7			yes
8	yes				8	yes		
9					9			
10					10			
11		yes			11		yes	
12					12			
13	yes				13	yes		
14					14			
15					15			

On		Collect			On		Collect	
IOP Days	Blank	Duplicate	Tandem		IOP Days	Blank	Duplicate	Tandem
1					1			
2					2			
3	yes				3	yes		
4					4			
5		yes			5		yes	
6					6			
7			yes		7			yes
8	yes				8	yes		
9					9			
10					10			
11		yes			11		yes	
12					12			
13	yes				13	yes		
14					14			
15					15			

On		Collect			On		Collect	
IOP Days	Blank	Duplicate	Tandem		IOP Days	Blank	Duplicate	Tandem
1					1			
2					2			
3	yes				3	yes		
4					4			
5		yes			5		yes	
6					6			
7			yes		7			yes
8	yes				8	yes		
9					9			
10					10			
11		yes			11		yes	
12					12			
13	yes				13	yes		
14					14			
15					15			

Instruction Points:

· Timer Operation
· Cartridge Installation and Removal on Consecutive IOP Days
· Taking a blank, duplicate and tandem sample.
· Filling out a logsheet.
· Cartridge storage and shipping: Cooler / Blue Ice; Fedex.

Date: _____

Instruction given to: _____

Instruction given by: _____

Contacts

ARB	Andy Ranzieri	916-324-4069		
ARB	Saffet	916-799-8205 cell	916/327-7298	sec.:916/324-4069
DRI	Eric Fujita	775/848-6881		
DRI	John Bowen	775/560-9246 cell	Dan Friedman	775/674-7048
ENSR	Chuck McDade	805/377-1359 cell		
T&B	Bill Keifer	707/975-4590 cell		
T&B	Don Lehrman	707/526-2775		
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AtmAA	K. Fung	818/458-4777		